A Retrospective Study Comparing Clinical Outcomes after Obturation with Resilon/Epiphany or Gutta-Percha/Kerr Sealer

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Abstract

The purpose of this retrospective study was to evaluate the treatment outcome of root canal systems obturated with gutta-percha and Kerr Pulp Canal Sealer compared with Resilon and Epiphany sealer. One hundred three teeth treated in a private endodontic practice were included in the study. Clinical outcomes (healed versus nonhealed) were assessed by using the Periapical Index determination and clinical evaluation at recall appointments. The magnitude of the association between obturation materials used and outcome measured was evaluated with univariate and multivariate logistic regression analysis. Univariate analysis indicated that pulpal vitality, presence of a preoperative lesion, and length of recall times were statistically significant in predicting the outcome. Logistic regression analysis showed that age, tooth position, and length of recall times were statistically significant in predicting the outcome. Root canal systems obturated with gutta-percha and Kerr Pulp Canal Sealer or Resilon and Epiphany sealer had statistically indistinguishable differences in clinical outcome. *(J Endod 2008;34: 789–797)*

Key Words

Clinical, endodontic, Epiphany, gutta-percha, outcome assessment, Resilon, sealer

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Bacteria and their by-products have been shown to be a cause of pulpal necrosis and apical periodontitis (1). A primary objective of endodontic therapy is to debride and clean the root canal system through mechanical and chemical means (2, 3). After thorough chemomechanical debridement, the canal system is obturated with a filling material, and this treatment regimen sets the stage for postoperative healing (4). As a major part of this therapeutic treatment, the obturation ideally confers 3 main functions: prevention of coronal ingress of bacteria, entombment of remaining bacteria, and prevention of accumulation of fluid apically that could serve as nutrients for bacteria (5).

Gutta-percha used with various sealers is the standard with which other obturating materials are compared (6). Recently a thermoplastic synthetic polymer-based root canal filling material has been developed that might be used as an alternative core obturation material. This material, Resilon (Resilon Research LLC, Madison, CT), is made of polycaprolactone and contains bioactive glass, bismuth oxychloride, and barium sulfate. The corresponding sealer, Epiphany Root Canal Sealant (Pentron Clinical Technologies, Wallingford, CT), is a dual-cure dental resin composite sealer (7). These obturation materials have been compared with gutta-percha and various sealers in preclinical studies evaluating microleakage (7, 8), fluid filtration leakage (9), cytotoxicity (10), surface characteristics after exposure to enzymes (11), and differences in inflammation in dogs with apical periodontitis (12). Resilon has also been evaluated clinically in a nonstandardized protocol (13).

In prospective and retrospective studies the outcome of treatment has been evaluated for teeth obturated with gutta-percha, and many factors have been assessed for their relationship to treatment outcome. Pulpal vitality (14–16), presence of a preoperative lesion (14, 15, 17–23), and length of recall time (17, 24, 25) have been shown in many studies to be significant factors affecting the outcome of root canal treatment. Additional factors that might also affect outcome are age (23), gender (15), tooth location (26), number of canals obturated (20), and single or multiple visits (27). Assessment of treatment outcome can be accomplished through the use of radiographic and/or clinical evaluation. Radiographic evaluation can be assessed through strict criteria (17) or through the use of the Periapical Index (PAI) system (28), and clinical interpretation can be evaluated through presentation of symptoms (18–20) or functionality (29) of the tooth treated.

The present retrospective study was designed to compare radiographic and clinical outcomes of teeth obturated with either Resilon and Epiphany sealer or gutta-percha and Kerr Pulp Canal Sealer (Kerr Corporation, Orange, CA) by using a single private practice site in which patients were assigned to either treatment by using an allocation method of treatment room assignment as described below. Both univariate and multivariate logistic regression analyses were used to evaluate the impact of the obturation method and other preoperative prognostic features on the clinical outcomes. The additional preoperative factors assessed were age, gender, tooth location, pulpal vitality, presence of preoperative periapical radiolucency, number of canals obturated, single or multiple visits, and length of recall times.

Materials and Methods

Sample Size/Endodontic Treatment

This study was approved by the Institutional Review Board of the University of Texas Health Science Center at San Antonio. The sample population was initially composed of 276 endodontically treated teeth of patients who were referred by general practitioners to a single practitioner endodontic practice located in Wichita, KS. The patients were treated between August 2003 and May 2004. The endodontic office in this study provided 2 fully equipped rooms for treatment. One room was equipped for obturation with gutta-percha and Kerr Pulp Canal Sealer and the other with Resilon and Epiphany sealer. All other equipment and instruments were the same in each treatment room. Patient assessment, treatment data, and radiographs were obtained by both the practitioner and his staff, with the diagnosis and treatment being provided by a single endodontist with 18 years of private practice experience. Digital radiographs were taken with a Sirona Heliodent DS unit (60 kilovolts (peak), 7 mA) (Sirona Dental Systems, LLC, Charlotte, NC) with variable exposure times, and Schick sensors and software (Schick Technologies, Inc, Long Island City, NY) were used to capture the radiographic images.

At each appointment, patients were seated in the first available treatment room. This patient allocation method did not take into account any demographic or preoperative variables at the time of treatment room assignment. Canals were obturated with the material assigned to the treatment room that the patient was in at the time of obturation, independent of the treatment room occupied at any previous visit. Every patient was anesthetized, and a rubber dam was placed. Access was made, canals were located, and coronal flare was obtained with a rotary ProFile GT size 20, 0.06 taper (Dentsply Tulsa Dental, Tulsa, OK). Stainless steel FlexoFile (Dentsply Maillefer, Tulsa, OK) hand files and an Elements Apex Locator (Sybron Endo, Orange, CA) were used to determine working length (WL) as the point at which the apex locator read 0.0. Then rotary K3 size 15–25 with a 0.02 taper (Sybron Endo) and rotary ProTaper S1, S2, and F1 (Dentsply Tulsa Dental) nickel-titanium (NiTi) files were used to initially clean and shape the canals to WL. LightSpeed NiTi rotary instruments (LightSpeed Technology, Inc, San Antonio, TX) were then used without rotary power to determine the largest size that would go past WL. This size was recorded, and the canal was then prepped with a K3 0.04 or 0.06 taper to the previously determined LightSpeed size. After canal preparation to the size of the largest LightSpeed that would go past WL, larger LightSpeed instruments were inserted. If a LightSpeed of 2 sizes or greater easily fit to within 1 mm of the WL, the canal would then be prepped with a K3 0.04 or 0.06 taper to match the larger size at the shorter length determined by the LightSpeed instrument.

Throughout treatment the canals were irrigated with 5.25% NaOCl warmed in a beaker on a beverage warming device (The Holmes Group, Warrensburg, MO). A final flush of hydrogen peroxide followed by a rinse of 17% ethylenediaminetetraacetic acid to remove the smear layer completed the irrigation. All irrigants were dispensed with a monojet syringe through a 30-gauge Max-i-Probe (Dentsply Rinn, Elgin, IL) needle. The volume of irrigants was not recorded. Canals were then dried with sterile paper points. For multiple visit appointments, UltraCal XS (Ultradent Products, Inc, South Jordan, UT) calcium hydroxide was dispensed into the canal by using a 30-gauge needle followed by a sterile cotton pellet and a temporary restoration of Cavit or intermediate restorative material (IRM).

Before obturation, WL length was confirmed with the Elements Apex Locator. A master cone of the obturation material to be used was selected to match the final size and taper of the canal preparation to WL, placed to length for assessment, and then removed. For canals that were prepared to a larger size within 1 mm short of WL, a cone of corresponding size and taper was selected, and the apical 3 mm of the cone was softened with chloroform. The cone was then fit to WL and removed.

For canals obturated with gutta-percha, Kerr Pulp Canal Sealer was mixed, and the gutta-percha master cone was coated and placed back to WL. For canals obturated with Resilon, a sterile paper point was used to apply the Epiphany primer to the walls of the canal. A dry paper point was then placed to length and used to absorb excess primer inside the root canal. The Resilon master cone was coated with Epiphany sealer and placed to length. Both obturation materials were then incrementally down packed by using a System B (Sybron Endo) and condensers. The goal was to down pack and condense to within 3 mm of WL or as close to that as possible. After the down pack, the canals were backfilled by using an Obtura II gun (Obtura Spartan, Fenton, MO) with the same obturation material as the master cone. The material was finally condensed at the orifice(s), with the Resilon and Epiphany sealer obturated canals being light-cured for 40 seconds.

After obturation, the chambers were closed with composite, amalgam, or a sterile cotton pellet followed by Cavit or IRM. The postobturation restoration was determined on the basis of the referring dentist's preference and the endodontist's judgment of maintaining a coronal seal.

After treatment, patients were mailed postcards and telephoned to set up a recall appointment. Also, if a patient was in the office for additional treatment of a different tooth, their previously treated tooth was recalled. A total of 117 treated teeth from 110 patients were recalled, with recall times ranging from 2–25 months. At the recall appointment, patients were seated, and a radiographic image was acquired. The treated tooth was percussed, the area was visually inspected and palpated, and any complaints by the patient were recorded. Asymptomatic/within normal limits (WNL) was recorded if no clinical symptoms were present. The type of restoration present at the time of recall was also recorded. Treatment and recall data were recorded and stored in the endodontic practice's TDO (Dog Breath Software, Inc, San Diego, CA) software. The data from the patients' charts were assessed retrospectively by independent observers consisting of a board-certified endodontist and an endodontic resident and analyzed by a statistician. None of the observers were involved in treatment of the teeth.

The data from 117 recalled teeth were subjected to various exclusion criteria without consideration as to the type of obturation material used. Initially, 3 teeth were eliminated from the study for various reasons. One tooth obturated with gutta-percha/Kerr sealer was extracted by a general dentist without being evaluated by the endodontist, another tooth obturated by gutta-percha/Kerr sealer was extracted as a result of a vertical root fracture confirmed on extraction, and a third tooth obturated with Resilon/Epiphany was re-treated as a result of an initial procedural error. Nine teeth (5 obturated with gutta-percha/Kerr sealer, 4 obturated with Resilon/Epiphany) were eliminated because either the immediate postoperative or the recall radiograph did not adequately show the apices and surrounding bone of the tooth being evaluated. In addition, 3 adjacent teeth in 1 patient had confluent periradicular radiolucencies, and all were obturated with Resilon/Epiphany at the same appointment. One tooth was selected randomly to be included in the study, and the other 2 were eliminated. After the exclusion criteria were applied, 103 endodontically treated teeth (50 obturated with gutta-percha/Kerr sealer, 53 obturated with Resilon/Epiphany) from 98 patients remained to be evaluated in the study. All teeth presented with permanent restorations at the time of recall. Eighty-three teeth (41 obturated with gutta-percha/Kerr sealer, 42 obturated with Resilon/Epiphany) were recalled at 12–25 months. The 12–25–month group was further divided into an intermediate recall group of 12–18 months having 15 teeth (8 obturated with gutta-percha/Kerr sealer, 7 obturated with Resilon/Epiphany) and a long recall group of more than 18 months